

Ref. No. : PE/PG/BIF/E-5815/2017/CORRIGENDA/12

Date: 31.05.2018

**CORRIGENDA / ADDENDUM-12**

**SUBJECT: 2X660 MW BIFPCL MAITREE KHULNA STPP-BANGLADESH**

**PACKAGE: OXYGEN DOSING SYSTEM**

**Our Ref : ENQUIRY No : PE/PG/BIF/E-5815/2017, Dtd. 28.12.2017**

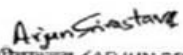
| DUE DATE          |
|-------------------|
| 11-June-2018      |
| BY 02:00 PM (IST) |

1. The subject tender has been shifted to new e-procurement website, i.e. <https://bhel.abcpurchase.com>. For bidder's convenience, the helpdesk numbers of E-Procurement service providers are attached with this Corrigendum as Annexure-1. Bidders who have submitted their bids on old e-procurement website will have to submit their bids again on new e-procurement website.
2. Bidders to note that there is minor change in Technical Specification no. PE-TS-421-154-A002. Technical Amendment no.2 to Technical Specification is attached herewith.
3. Bidders to note that there is change in BOQ. Revised Price Format is attached herewith.
4. Bidders to note that Delivery Term/ Delivery Point shall be F.O.R CHA Godown Haldia port / Haldia Port / CHA Godown Kolkata port / Kolkata port.

The bid submission of tender for above referred project and package is **extended up to 11.06.2018 at 02:00 PM through e-procurement system.**

Thanking You.

For & on Behalf of BHEL,

  
अरुण श्रीवास्तव / ARJUN SRIVASTAVA  
सीनियर इंजीनियर (पी.एच.ई.) / Sr. Engineer (PG-I)  
भारत भारी इलेक्ट्रिकल्स लिमिटेड / Bharat Heavy Electricals Ltd.  
पावर सेक्टर - प्रोजेक्ट इंजीनियरिंग प्रबंधन  
Power Sector - Project Engineering Management  
ब्लॉक नं. 25, डक्टर - 16A, फ़्लोर - 201 301  
Plot No. 25, Doctor - 16A, Floor - 201 301

Arjun Srivastava  
Sr. Engr/PG-I

Arjun Srivastava, Sr. Engineer/PG-I/PEM  
Power Project Engineering Institute Building  
HRD & ESI Complex Plot No. 25, Sector -16 A,  
BHEL-PEM, Noida-201301 (U.P.)  
Tel No. 0120-4368839, 9971599688

## **ANNEXURE 1 – INSTRUCTION REGARDING E-PROCUREMENT**

**Digital Certificate:** To access an e-Tender, you need to have a Class-II/III Digital Signature Certificate (DSC) for Signing & Encryption (Required both digital signature certificate: Signing & Encryption) of bids issued by any of the valid Certifying Authorities (approved by Controller of Certifying Authorities) in India. Valid Digital Signature Certificate (DSC) must be installed in a computer system from where you want to access the website.

### **MINIMUM REQUIREMENT: (Mandatory)**

- Computer with good Internet Connection.
- Operating System should be Windows Vista / Windows 7 and above.
- Web Browsers: Internet Explorer 9.0 (32-bit Browser only) & above

**At first time login, to verify and approve your login profile & DSC, you are requested to contact e-Procurement Service Provider.**

### **E-procurement service Provider details:**

M/s e Procurement Technologies limited, Ahmedabad

B705. Wall Street II, Opp Orient Club, Near Gujrat college, Ellis Bridge, Ahmedabad, PIN 380 006.

Please get in touch with service provider at the earliest for required support.

The contact details of the service provider is given below:

| <b>Name</b>        | <b>Contact Nos.</b> | <b>e-mail ID</b>                                                   | <b>Role</b>                                 | <b>Location</b> |
|--------------------|---------------------|--------------------------------------------------------------------|---------------------------------------------|-----------------|
| Mukunthan          | +91 6353215001      | <a href="mailto:Trichy.bhel@eptl.in">Trichy.bhel@eptl.in</a>       | Support Executive                           | Trichy          |
| Tej Singh          | +91 6353215002      | <a href="mailto:Bhopal.bhel@eptl.in">Bhopal.bhel@eptl.in</a>       | Support Executive                           | Bhopal          |
| Sanjeev Kumar      | +91 6353215003      | <a href="mailto:Jhansi.bhel@eptl.in">Jhansi.bhel@eptl.in</a>       | Support Executive                           | Jhansi          |
| Gaurav Panwar      | +91 6353215004      | <a href="mailto:Haridwar.bhel@eptl.in">Haridwar.bhel@eptl.in</a>   | Support Executive                           | Haridwar        |
| Mallikarjun        | +91 6353215005      | <a href="mailto:Bengaluru.bhel@eptl.in">Bengaluru.bhel@eptl.in</a> | Support Executive                           | Bangalore       |
| Avinash Govu       | +91 6353215007      | <a href="mailto:Hyderabad.bhel@eptl.in">Hyderabad.bhel@eptl.in</a> | Support Executive                           | Hyderabad       |
| Swapnil Hamilton   | +91 7940270549      | <a href="mailto:swapnil.h@eptl.in">swapnil.h@eptl.in</a>           | Support Executive                           | HO – Ahmedabad  |
| Hardik Oza         | +91 7940270560      | <a href="mailto:Hardik.oza@eptl.in">Hardik.oza@eptl.in</a>         | Support Executive                           | HO – Ahmedabad  |
| Ankur Bhatt        | +91 7940270590      | <a href="mailto:ankur.bhatt@eptl.in">ankur.bhatt@eptl.in</a>       | Support Executive                           | HO – Ahmedabad  |
| Prashant Rajyaguru | +91 7940270545      | <a href="mailto:prashant@eptl.in">prashant@eptl.in</a>             | Asst. Manager –<br>Implementation & Support | HO – Ahmedabad  |
| Dharam Rathod      | +91 7940270596      | <a href="mailto:dharam@eptl.in">dharam@eptl.in</a>                 | Manager –<br>Implementation & Support       | HO – Ahmedabad  |
| Pradip Parmar      | +91 7940270532      | <a href="mailto:pradip@eptl.in">pradip@eptl.in</a>                 | Sr Mgr – Implementation<br>& Support        | HO – Ahmedabad  |
| Devang Patel       | +91 7940270576      | <a href="mailto:devang@eptl.in">devang@eptl.in</a>                 | Sr Manager –<br>Implementation & Support    | HO – Ahmedabad  |

| REVISED PRICE FORMAT     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                              |        |     |                                                                           |                                                                            |                                                                                                    |                      |                                               |                                        |                  |                                                 |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|--------|-----|---------------------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------|-----------------------------------------------|----------------------------------------|------------------|-------------------------------------------------|
| NAME OF PROJECT:         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2 X 660MW MATREE SUPER THERMAL POWER PROJECT |        |     |                                                                           |                                                                            |                                                                                                    |                      |                                               |                                        |                  |                                                 |
| NAME OF PACKAGE:         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | OXYGEN DOSING SYSTEM                         |        |     |                                                                           |                                                                            |                                                                                                    |                      |                                               |                                        |                  |                                                 |
| Enq No.                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PE/PGH/E-5815/2017, Dt. 28.12.2017           |        |     |                                                                           |                                                                            |                                                                                                    |                      |                                               |                                        |                  |                                                 |
| TECHNICAL SPECIFICATION: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PE-TS-421-154-A002                           |        |     |                                                                           |                                                                            |                                                                                                    |                      |                                               |                                        |                  |                                                 |
| S. No.                   | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                             | HSN / SAC CODE                               | UNIT   | QTY | UNIT EX-WORKS PRICE<br>(Duly packed including seaworthy packing)<br>(INR) | TOTAL EX-WORKS PRICE<br>(Duly packed including seaworthy packing)<br>(INR) | FREIGHT CHARGES UPTO CHA Godown Haldia port / Haldia Port / CHA Godown Kolkata port / Kolkata port |                      | TOTAL PRICES<br>(EX-WORKS + FREIGHT)<br>(INR) | APPLICABLE GST RATE IN % OF BOTH (INR) |                  | TOTAL SUPPLY PRICE and SUPERVISION OF E&C (INR) |
|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                              |        |     |                                                                           |                                                                            | FREIGHT IN % OF TOTAL EX WORKS)                                                                    | FREIGHT AMOUNT (INR) |                                               | GST RATE IN % (10A)                    | GST AMOUNT (INR) |                                                 |
|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                              |        |     |                                                                           |                                                                            |                                                                                                    |                      |                                               |                                        |                  |                                                 |
| (1)                      | (2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | (3)                                          | (4)    | (5) | (6)                                                                       | (7) = [5X6]                                                                | (8A)                                                                                               | (8B) = [7X8A]        | (9) = [7+8B]                                  | (10A)                                  | (10B) = [9X10A]  | (11) = [9+10B]                                  |
| 1.1                      | Oxygen dosing skid (including oxygen cylinders mounted on each skid)                                                                                                                                                                                                                                                                                                                                                                                                    | 8404 1000                                    | Nos.   | 4   |                                                                           |                                                                            |                                                                                                    |                      |                                               | 0.1%                                   |                  |                                                 |
| 1.2                      | Accessories - Injector Assembly                                                                                                                                                                                                                                                                                                                                                                                                                                         | 8404 1000                                    | Nos.   | 8   |                                                                           |                                                                            |                                                                                                    |                      |                                               | 0.1%                                   |                  |                                                 |
| 1.3                      | Accessories - 15 NB, SS 316, 18 BWG tubing for oxygen dosing                                                                                                                                                                                                                                                                                                                                                                                                            | 8404 1000                                    | Meters | 480 |                                                                           |                                                                            |                                                                                                    |                      |                                               | 0.1%                                   |                  |                                                 |
| 1.4                      | Accessories - SS 316 Tube fittings -tees                                                                                                                                                                                                                                                                                                                                                                                                                                | 8404 1000                                    | Nos.   | 20  |                                                                           |                                                                            |                                                                                                    |                      |                                               | 0.1%                                   |                  |                                                 |
| 1.5                      | Accessories - SS 316 Tube fittings -90° elbows                                                                                                                                                                                                                                                                                                                                                                                                                          | 8404 1000                                    | Nos.   | 20  |                                                                           |                                                                            |                                                                                                    |                      |                                               | 0.1%                                   |                  |                                                 |
| 1.6                      | Accessories - Filled oxygen cylinders                                                                                                                                                                                                                                                                                                                                                                                                                                   | 8404 1000                                    | Nos.   | 32  |                                                                           |                                                                            |                                                                                                    |                      |                                               | 0.1%                                   |                  |                                                 |
| 1.7                      | Accessories - Compression fittings                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8404 1000                                    | Nos.   | 90  |                                                                           |                                                                            |                                                                                                    |                      |                                               | 0.1%                                   |                  |                                                 |
| 1.8                      | Accessories - Solenoid Valves                                                                                                                                                                                                                                                                                                                                                                                                                                           | 8404 1000                                    | Nos.   | 2   |                                                                           |                                                                            |                                                                                                    |                      |                                               | 0.1%                                   |                  |                                                 |
| 1.9                      | Accessories - Rack to hold 16 nos. filled oxygen cylinders                                                                                                                                                                                                                                                                                                                                                                                                              | 8404 1000                                    | Nos.   | 2   |                                                                           |                                                                            |                                                                                                    |                      |                                               | 0.1%                                   |                  |                                                 |
| 1.0                      | <b>Total of prices of S.No.1.1 to 1.9: Prices for MAIN SUPPLY</b> comprising of design (i.e.preparation and submission of drawing documents including 'As Built' drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, forwarding, proper packing, shipment, delivery at site & guarantee as per tender technical specification, amendment & agreements till placement of order. |                                              |        |     |                                                                           |                                                                            |                                                                                                    |                      |                                               |                                        |                  |                                                 |
| 2.0                      | <b>Total lumpsum firm price for MANDATORY SPARES</b> comprising of manufacture, fabrication, assembly, inspection / testing (as applicable) at vendors & sub-vendor's works, painting, forwarding, proper packing, shipment, delivery at site & guarantee as per tender technical specification, amendment & agreements till placement of order.                                                                                                                        |                                              |        |     |                                                                           |                                                                            |                                                                                                    |                      |                                               |                                        |                  |                                                 |
| 3.0                      | <b>Total lumpsum firm price for SUPERVISION OF E&amp;C of skids (Ten (10) man days and two (2) nos. site visit)</b> as per tender technical specification above, amendment & agreements till placement of order. The prices shall be inclusive of charges of airfreight & fro), boarding, lodging, visa, medical, insurance etc.                                                                                                                                        |                                              |        |     |                                                                           |                                                                            |                                                                                                    |                      |                                               |                                        |                  |                                                 |

**TOTAL QUOTED AMOUNT IN WORDS:**

**PERCENTAGE OF TOTAL PRICE THAT WILL BE SOURCED FROM INDIA:**

**[POINTS FOR CONSIDERATION BEFORE FILLING ABOVE PRICE SCHEDULE-**

- Prices Shall Be Firm Unless Otherwise Specifically Indicated In NIT .
- In case of discrepancy in GST rate corresponding to HSN code and quoted GST, the evaluation shall be done on quoted price and correct GST rates shall be considered for ordering (limited to quoted FOR Site price)
- Unless the context requires otherwise, in all tenders and tender related documents but reference to the amount and percentage in the order/contract.
- GST/SGST/IGST shall be paid at actuals against documentary evidence but restricted to the amount and percentage in the order/contract.
- In case, any GST credit is delayed/denied to BHEL due to non/delayed receipt of goods and/or tax invoice or expiry to timeline prescribed in the relevant Act for availing such ITC, or any other reasons not attributable to BHEL, tax amount shall be recoverable from the vendor/contractor along with interest levied/leviable on BHEL.
- All taxes and duties other than GST/SGST/IGST shall be deemed to be included in the Ex-Works prices unless specified otherwise by the bidder in the price bid. No variation in other taxes and duties shall be payable by Purchaser.

  
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 Sr. Asstt. Mgr. (Procurement)  
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 Fax: 0846-2200000  
 E-mail: anil.kumar@bhel.co.in



|                                                                                                                                               |  |                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------|
| AMENDMENT TO TECHNICAL SPECIFICATION<br>FOR<br>OXYGEN DOSING SYSTEM<br>2 X 660MW MAITREE SUPER THERMAL POWER PROJECT<br>AT RAMPAL, BANGLADESH |  | SPECIFICATION NO.: PE-TS-421-154-A002<br>AMENDMENT NO # 2<br>REV. NO. 00<br>DATE: 21/05/2018<br>Page 1 of 1 |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------|

The following modifications with respect to Technical Specification for OXYGEN DOSING SYSTEM. BHEL's Technical specification no **PE-TS-421-154-A002** shall apply.

Bidder to note that existing clauses/ details as appearing in the specification stands deleted and clauses/details as mentioned in "Modified to or Read as" column shall be applicable and complied by the bidder as listed below in **SCHEDULE A**.

**SCHEDULE-A**

**MODIFIED CLAUSES/ PAGE NUMBERS:**

| Sl no. | Vol. No. | Section/ Description | Clause no | Page no           | Existing clause/details                                                                                                                      | Modified to or Read as                                                                                                                                                                                                                                                             |
|--------|----------|----------------------|-----------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.     | IIB      | SECTION- IA          | 1.0       | 4 of 448          | • Injector assemblies (8 nos.), tees (20 nos.), elbows (20 nos.), loose tubing (480 meter), compression fittings (90 nos.) for loose tubing. | The referred clause shall be read as Injector assemblies (8 nos.), tees (20 nos.), elbows (20 nos.), loose tubing (480 meter), compression fittings (90 nos.) for loose tubing. In addition, total two number solenoid valve shall be supplied as loose item along with the skids. |
| 2.     | IIB      | SECTION- IA          |           | 396 to 397 of 448 | DATA SHEET                                                                                                                                   | The referred Data Sheet stands deleted. Please refer to Annexure-2 for revised Data Sheet.                                                                                                                                                                                         |
| 3.     | IIB      | SECTION- IIA         |           | 402 to 406 of 448 | SECTION - IIA<br>GENERAL TECHNICAL REQUIREMENT<br>(MECHANICAL)                                                                               | The referred section stands deleted. Please refer to Annexure-2 for revised SECTION - IIA<br>GENERAL TECHNICAL REQUIREMENT<br>(MECHANICAL)                                                                                                                                         |
| 4.     | IIB      | SECTION- IA          |           | 394 to 395 of 448 | P&IDs                                                                                                                                        | The referred P&IDs stands deleted. Please refer to Annexure-2 for revised P&IDs.                                                                                                                                                                                                   |

\*\*\*\*\*

8/15/18

(JITENDRA PAL)

SE. P&ID. - MANU

21/5/18  
(Sudeep)

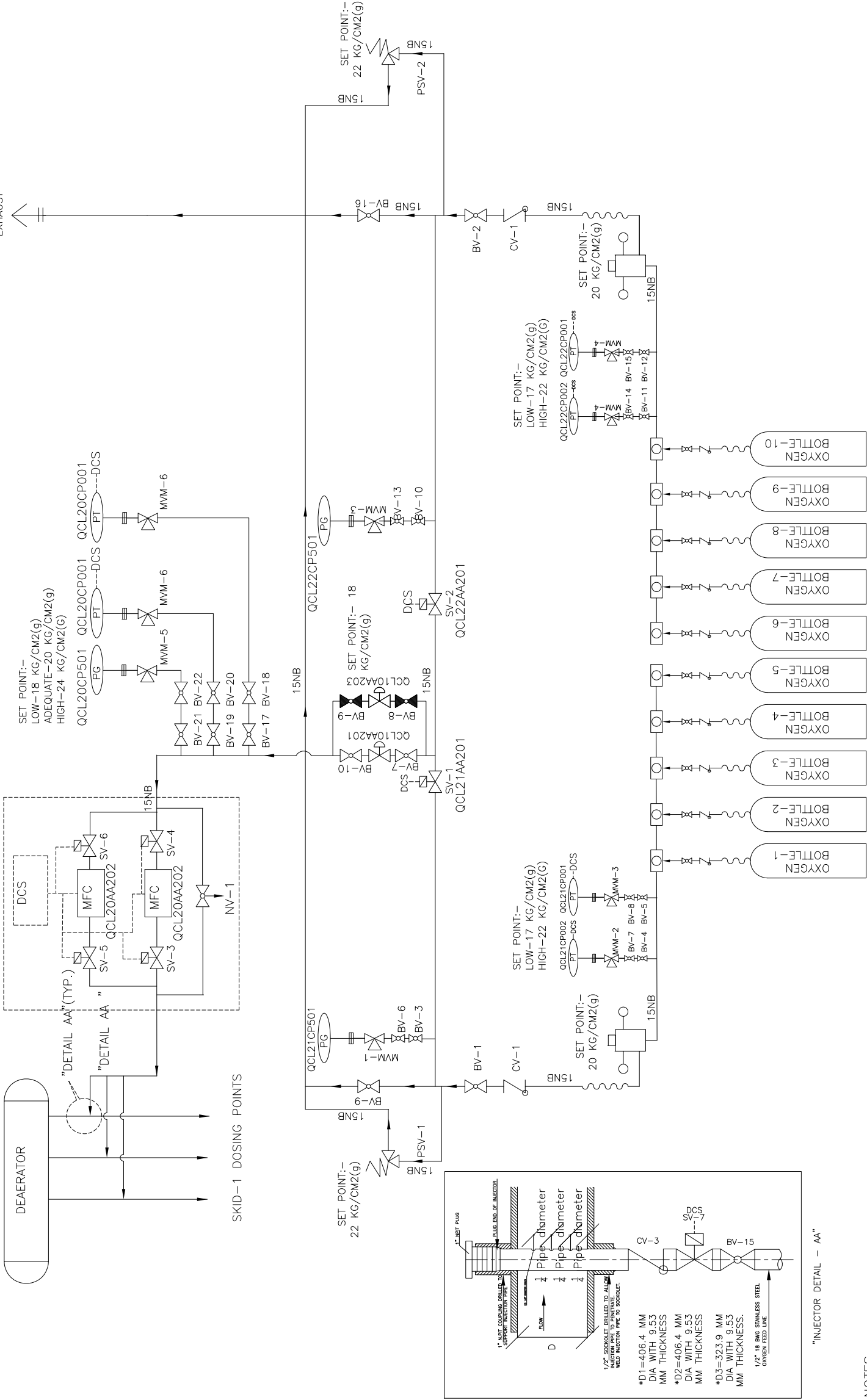
Dy Pmgr / MTR

|                                                                                  |                                                                        |                                      |                   |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------|-------------------|
|  | <b>TITLE :</b><br><b>2 X 660MW MAITREE SUPER THERMAL POWER PROJECT</b> | SPECIFICATION NO. PE-TS-421-154-A002 |                   |
|                                                                                  |                                                                        | SECTION I                            |                   |
|                                                                                  | <b>TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM</b>                | SUB SECTION IA                       |                   |
|                                                                                  |                                                                        | <b>REV. NO.</b> 00                   | DATE : 15.05.2018 |

**P&IDs**



MAITREE-01-LA-MFB-119105-PEN



"INJECTOR DETAIL - AA"

NOTES: —

- 1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
- 2 ONE NUMBER SKID PER UNIT SHALL BE PROVIDED FOR DOSING AT DEAERATOR OUTLET (TOTAL=2 NOS).
- 3 THREE NUMBERS INJECTION ASSEMBLY PER UNIT SHALL BE SUPPLIED LOOSE (TOTAL = 6 NOS).
- 4 ALL THE VALVES SHALL BE OF SS 316.
- 5 ALL TUBING SHALL BE OF SS 316, 15 NB AND 18 BWG.

BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT) LTD.

2X660 MW BIFCL MATREE KHULNA STPP, (BANGLADESH)

|  |      |      |      |     |      |                     |
|--|------|------|------|-----|------|---------------------|
|  | REV. | DATE | ALTD | CHD | APPD | JOB No. <b>421</b>  |
|  |      |      |      |     |      | <b>STATUS</b>       |
|  |      |      |      |     |      | <b>CONTRACT</b>     |
|  |      |      |      |     |      | <b>DISTRIBUTION</b> |

|                                                                                       |                                                                                             |  |  |  |  |              |      |      |      |        |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--|--|--|--|--------------|------|------|------|--------|
|  | BHARAT HEAVY ELECTRICALS LTD<br>POWER SECTOR<br>PROJECT ENGINEERING MANAGEMENT<br>NEW DELHI |  |  |  |  | DEPT<br>CODE |      | NAME | SIGN | DATE   |
|                                                                                       |                                                                                             |  |  |  |  |              | DRN  | SP   |      |        |
|                                                                                       |                                                                                             |  |  |  |  | A            | DESN | SP   |      |        |
|                                                                                       |                                                                                             |  |  |  |  |              | CHD  | JP   |      |        |
|                                                                                       |                                                                                             |  |  |  |  |              | APPD | JP   |      |        |
| TITLE P&ID FOR OXYGEN DOSING<br>SKID AT DEAERATOR OUTLET                              |                                                                                             |  |  |  |  | DRAWING No.  |      |      |      |        |
|                                                                                       |                                                                                             |  |  |  |  | SHEET        | 02   | OF   | 02   | REV 02 |

SIZE-A3

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**TITLE :**  
**2 X 660MW MAITREE SUPER THERMAL POWER  
PROJECT**

SPECIFICATION NO. PE-TS-421-154-A002

SECTION I

**TECHNICAL SPECIFICATION FOR OXYGEN  
DOSING SYSTEM**

SUB SECTION IA

**REV. NO. 00**

DATE : 15.05.2018

**DATA SHEET**



**TITLE :**  
**2 X 660MW MAITREE SUPER THERMAL POWER PROJECT**

SPECIFICATION NO. PE-TS-421-154-A002

SECTION I

**TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM**

SUB SECTION IA

REV. NO. 00

DATE : 15.05.2018

| Sl. No                  | Description                                | Parameter                                                                                                                 |
|-------------------------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Mechanical Items</b> |                                            |                                                                                                                           |
| 1.0                     | No. of skid(s) for project                 | Four (two per unit)                                                                                                       |
| 2.0                     | <b>Cylinders:</b>                          |                                                                                                                           |
| 2.1                     | Quantity mounted on skid                   | Ten per skid for Deareator and Eight per skid for CPU outlet (Total Thirty Six)                                           |
| 2.2                     | Design Standard of empty oxygen cylinder   | ISO 9809 Part-1                                                                                                           |
| 2.3                     | Water Capacity                             | 50 liters                                                                                                                 |
| 2.4                     | Gas Capacity                               | 10 m <sup>3</sup>                                                                                                         |
| 2.5                     | Max Working pressure at 15°C               | 204 Kg/cm <sup>2</sup>                                                                                                    |
|                         | Accessories                                | Two numbers (one per unit) Cylinder storing rack (MS), each with capacity to hold 16 cylinders                            |
| 3.0                     | <b>All Tubing:</b>                         |                                                                                                                           |
| 3.1                     | Material                                   | SS 316                                                                                                                    |
| 3.2                     | Diameter                                   | 15 NB (1/2" OD), 18 BWG                                                                                                   |
| 4.0                     | <b>Ball valves</b>                         |                                                                                                                           |
| 4.1                     | Body, Bonnet, stem                         | SS 316                                                                                                                    |
| 4.2                     | Trim Material                              | SS 316                                                                                                                    |
| 4.3                     | Design standard                            | MSS-99-2010/ Equivalent                                                                                                   |
| 4.4                     | Test standard                              | MSS-99-2010/ Equivalent                                                                                                   |
| 4.5                     | Size                                       | 15 NB                                                                                                                     |
| 4.6                     | End Connections                            | Ferruled                                                                                                                  |
| 4.7                     | Rating                                     | 2000 PSI                                                                                                                  |
| 4.8                     | Valve operation                            | Manual or pneumatic as per P&ID                                                                                           |
| 5.0                     | <b>Check valves/ NRV</b>                   |                                                                                                                           |
| 5.1                     | Body, cover, disc/piston & seat            | SS 316                                                                                                                    |
| 5.2                     | Design standard                            | MSS-99-2010/ Equivalent                                                                                                   |
| 5.3                     | Test standard                              | MSS-99-2010/ Equivalent                                                                                                   |
| 5.4                     | Size                                       | 15 NB                                                                                                                     |
| 5.5                     | End Connections                            | Ferruled                                                                                                                  |
| 5.6                     | Rating                                     | 2000 PSI                                                                                                                  |
| 5.7                     | Valve operation                            | Manual                                                                                                                    |
| 6.0                     | <b>Pressure relief valve</b>               |                                                                                                                           |
| 6.1                     | Type                                       | Spring loaded, angle type                                                                                                 |
| 6.2                     | Body, bonnet, disc & nozzle                | SS 316                                                                                                                    |
| 6.3                     | Valve discharges to                        | Atmosphere (vent)                                                                                                         |
| 6.4                     | Back pressure                              | Constant                                                                                                                  |
| 6.5                     | Set pressure                               | 55 Kg/cm <sup>2</sup> (g) for skid 1 and 22 Kg/cm <sup>2</sup> (g) for skid 2                                             |
| 6.6                     | Inlet Connections                          | Ferruled                                                                                                                  |
| 6.7                     | Outlet Connections                         | Ferruled                                                                                                                  |
| 7.0                     | <b>Fittings</b>                            | SS-316                                                                                                                    |
| 8.0                     | <b>Pressure Regulator</b>                  |                                                                                                                           |
| 8.1                     | Quantity                                   | Two per skid (total 8), each mounted to an oxygen cylinder                                                                |
| 8.2                     | Body & trim                                | SS 316/Brass                                                                                                              |
| 8.3                     | Inlet connection                           | 1/2 "                                                                                                                     |
| 8.4                     | Outlet connection                          | 1/2 "                                                                                                                     |
| 8.5                     | Operating pressure                         | 204 Kg/cm <sup>2</sup> (g)                                                                                                |
| 8.6                     | Set outlet Pressure                        | 48 Kg/cm <sup>2</sup> (g) for skid dosing at CPU outlet and 18 Kg/cm <sup>2</sup> (g) for skid dosing at deaerator outlet |
| 9.0                     | <b>Mass Flow Controller</b>                |                                                                                                                           |
| 9.1                     | Expected Flow of O <sub>2</sub> in process | 50-400 gm/ hr. (for skid dosing at deaerator outlet); 40-300 gm/ hr. (for skid dosing at CPU outlet)                      |
| 9.2                     | MOC-wetted parts                           | SS 316                                                                                                                    |
| 9.3                     | Operating pressure                         | Pressure reducing valve set pressure (refer P&IDs)                                                                        |
| 10.0                    | <b>Structural steel</b>                    | IS 2062                                                                                                                   |
| 11.0                    | <b>Nuts &amp; bolts</b>                    | SS 304                                                                                                                    |



**TITLE :**  
**2 X 660MW MAITREE SUPER THERMAL POWER  
PROJECT**

SPECIFICATION NO. PE-TS-421-154-A002

SECTION I

**TECHNICAL SPECIFICATION FOR OXYGEN  
DOSING SYSTEM**

SUB SECTION IA

**REV. NO. 00**

DATE : 15.05.2018

**SECTION - IIA**  
**GENERAL TECHNICAL REQUIREMENT (MECHANICAL)**

|                                                                                  |                                                                        |                                      |                   |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------|-------------------|
|  | <b>TITLE :</b><br><b>2 X 660MW MAITREE SUPER THERMAL POWER PROJECT</b> | SPECIFICATION NO. PE-TS-421-154-A002 |                   |
|                                                                                  |                                                                        | SECTION I                            |                   |
|                                                                                  | <b>TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM</b>                | SUB SECTION IA                       |                   |
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## 1.0 CODES AND STANDARDS

- a) MSS-99-2010
- b) ASTM G63: Guide for evaluating non-metallic materials for oxygen service.
- c) ASTM G93: Standard Practice for Cleaning Methods and Cleanliness Levels for Material and Equipment Used in Oxygen-Enriched Environments.
- d) ASTM G 94: std. guide for evaluating Metals for oxygen service.
- e) ASTM F1792-97 (2010): Standard Specification for Special Requirements for Valves Used in Gaseous Oxygen Service.
- f) ASTM G88: Standard Guide for Designing Systems for Oxygen Service.

The following philosophy oxygen dosing system is considered: -

## 2.0 SYSTEM DESCRIPTION

The objective of providing the dosing systems is to maintain the chemistry of the boiler feed water and also to comply with different modes of operation i.e. "Combined Water Treatment mode" during continuous plant operation and "Ammoniacal mode or AVT (O) mode" during start-up & shutdown conditions for super critical boiler of main plant.

The chemical feed for Combined Water Treatment (CWT) involves the feed of only aqueous ammonia and gaseous oxygen.

- a) **During normal operation:-**
  - pH is maintained at 8.2-8.5 by dosing aqueous ammonia solution.
  - Oxygen dosing rate recommended by BHEL is 30-150 ppb. Exact dosing rate shall be decided by the operator. For sizing of oxygen dosing system, 150 ppb continuous dosing of 99% pure oxygen has been considered.
  - Dosing shall normally be done at CPU outlet. However provision shall be given for dosing at deaerator outlet also. For this purpose two separate skid based oxygen dosing systems shall be supplied for each unit. However, dosing shall be done at one place at a time only.
  - Dosing rate shall be controlled from DCS by regulating mass flow controller (MFC) provided on each O<sub>2</sub> dosing skid under full load conditions based on dissolved oxygen level at economizer inlet. Oxygen dosing rate can be adjusted in the range of 30-150 ppb from DCS. However, **Customer** may also chose to manually feed a particular set point within this range and operate the oxygen dosing automatically based on this set point.
  - The oxygen dosing shall automatically turn off by closing the mass flow controller (MFC), if cation conductivity in the cycle goes above 0.3 us/cm.
- b) **Startup sequence:-**
  - Deaerator vent is kept open.
  - Ammonia is dosed at CPU outlet to achieve a pH of 9.2.
  - Cation conductivity reaches below 0.15 µs/cm (at 25°C) and the trend is downwards.
  - Deaerator vents are closed.
  - Oxygen feed is manually started from DCS.
- c) **Shut down sequence:-**
  - Oxygen feed needs to be stopped one hour before shut down and deaerator and LP heater vents needs to be opened.
  - Ammonia dosing rate needs to be increased to achieve pH in the range of 9.2.

Each skid shall consist of the following components:-

### 4.1.1 Cylinder banks

Each oxygen dosing skid shall consist of a two banks of five oxygen cylinders each for deaerator and two banks of four oxygen cylinders each for CPU outlet. The automatic change-over of cylinder takes place on the basis of pressure i.e. the cylinder banks dosing at Condensate Polishing Unit (CPU) outlet will switch over at 47 kg/cm<sup>2</sup>(g) and the cylinder banks dosing at deaerator outlet at 17 kg/cm<sup>2</sup>(g). Separate storage rack for additional seven-day consumption shall be provided to store oxygen cylinders.

### 4.1.2 Pressure Regulator:

The line pressure regulator is used for reducing a high supply pressure (204 bars cylinder pressure) to 50 kg/cm<sup>2</sup>(g) pressure in skid dosing at CPU outlet and to 20 kg/cm<sup>2</sup>(g) pressure in skid dosing at deaerator outlet.

|                                                                                  |                                                                        |                                      |                   |
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**4.1.3** Valves, tubing, vents and instrumentation shall be as per the enclosed P&ID and the data sheet. The MOC and specification of the equipment shall be as per the enclosed data sheet.

#### **4.2 CONTROL PHILOSOPHY (OXYGEN DOSING SYSTEM)**

The mode of operation of the oxygen dosing system shall be from Plant DCS only. All the logics, controls and interlocks shall be implemented in Plant DCS. Local manual intervention is not envisaged. Both manual/automatic controls shall be implemented in DCS. The provision to select "Auto" or "Manual" mode shall be provided in Plant DCS -OWS only.

The oxygen gas shall be at high pressure (204 Kg/cm<sup>2</sup>) in the cylinders. The same shall be brought to a lower pressure by the Pressure Regulator (set pressure of 50 Kg/cm<sup>2</sup> for skid dosing at CPU outlet and set pressure of 20 Kg/cm<sup>2</sup> for skid dosing at deaerator outlet attached with each cylinder.

Each set of oxygen cylinders in the skid shall have a dedicated set of solenoid valve, pressure gauge and pressure transmitter. Ten/eight cylinders provided on skid are connected and Five/four cylinder will serve at a time based on the pressure at the inlet of solenoid valve. In case the pressure at the inlet of SV1 reaches at the set point, the solenoid valve SV1 will close and solenoid valve SV2 will open and other cylinder shall be taken in to service provided the pressure at the inlet of SV2 is not low and vice versa. Alarm for pressure low at the inlet of solenoid valves shall be provided in DCS.

A pressure relief valve shall be fitted at the downstream of solenoid valve to relieve system pressure if the system pressure goes above set pressure.

The pressure of the oxygen shall be further reduced by pressure reducing valves for skid dosing at CPU outlet and skid dosing at deaerator outlet based on the feedback received from pressure transmitter {set point –"ADEQUATE"--(Set points–48 kg/cm<sup>2</sup> for skid dosing at CPU outlet & pressure transmitter {set point –"ADEQUATE"--(20 kg/cm<sup>2</sup> for skid dosing at deaerator outlet) provided at the downstream of pressure reducing regulating valve. The flow and pressure of oxygen can be monitored from DCS by the signal from mass flow controller for skid dosing at CPU outlet and for skid dosing at deaerator outlet and from pressure transmitters for skid dosing at CPU outlet & for skid dosing at deaerator outlet provided at the downstream of pressure reducing regulating valve. The flow of oxygen dosing will be controlled manually/automatically from DCS by adjusting flow MFC for skid dosing at CPU outlet & for skid dosing at deaerator outlet provided on skid, based on the feedback from the dissolved oxygen analyzer located in the economizer inlet. The MFC shall have a position feedback transmitter that shall transmit the feedback signal to Plant DCS. In case working MFC malfunctions, automatic changeover of MFC shall take place.

All solenoid valves mounted in the oxygen dosing skid shall be of 24 VDC rating. All the field instruments, MFC and solenoid valves shall be terminated at a junction box in the skid by BHEL's oxygen dosing vendor for further connection to Plant DCS. The cabling from JB to plant DCS shall be in BHEL scope.

At each dosing point, viz. CPU outlet and deaerator outlet, an injection assembly containing 15 NB tubing, fixing collar, solenoid valve and NRV shall be supplied loose by oxygen dosing vendor and erection/commissioning shall be done by BHEL.

The set points indicated below for operation of pressure reducing valve are tentative. Final value of the same shall be decided by oxygen dosing vendor during detailed engineering as per the requirement of the flow meter-cum-transmitter manufacturer.



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**For Skid dosing at CPU Outlet (CEP Discharge)**

| Source of signal                        | Tag Number         | Set Point (suggested)                       | Interlock                                                                                                                          | Alarm in DCS                                                                    | Remarks                                                                                                                                                                                            |
|-----------------------------------------|--------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><u>During Normal Operation:-</u></b> |                    |                                             |                                                                                                                                    |                                                                                 |                                                                                                                                                                                                    |
| Pressure transmitter                    | PT (QCL11CP001/2)  | 55 Kg/cm <sup>2</sup> (g) (HIGH)            | Not applicable                                                                                                                     | Yes (HIGH pressure at cylinder 1 outlet)                                        | Manual checking of pressure regulator reqd.                                                                                                                                                        |
| Pressure transmitter                    | PT (QCL11CP001/2)  | 47 Kg/cm <sup>2</sup> (g) (LOW)             | Close SV-1(QCL11AA201) & Open SV-2 (QCL12AA201)                                                                                    | Yes (LOW pressure at cylinder 1 outlet)                                         | Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.                                                                                                                    |
| Pressure transmitter                    | PT (QCL12CP001/2)  | 55 Kg/cm <sup>2</sup> (g) (HIGH)            | Not applicable                                                                                                                     | Yes (HIGH pressure at cylinder 2 outlet)                                        | Manual checking of pressure regulator reqd.                                                                                                                                                        |
| Pressure transmitter                    | PT (QCL12CP001/2)  | 47 Kg/cm <sup>2</sup> (g) (LOW)             | Close SV-2(QCL12AA201) & Open SV-1(QCL11AA201)                                                                                     | Yes (LOW pressure at cylinder 2 outlet)                                         | Auto-changeover of cylinders. Manually replace cylinder 2 with filled cylinder.                                                                                                                    |
| Pressure transmitter                    | PT (QCL10CP001/2)  | 46 Kg/cm <sup>2</sup> (g) (LOW)             | Close MFC (QCL10AA202)                                                                                                             | Yes (Oxygen dosing stopped due to low pressure)                                 |                                                                                                                                                                                                    |
| Pressure transmitter                    | PT (QCL10CP001/2)  | 50 Kg/cm <sup>2</sup> (g) (HIGH)            | Not applicable                                                                                                                     | Yes (HIGH dosing pressure)                                                      | Manual checking of pressure reducing valve reqd.                                                                                                                                                   |
| Pressure transmitter                    | PT (QCL10CP001/2)  | 48 Kg/cm <sup>2</sup> (g) (Adequate)        | Open Permissive of pressure MFC(QCL10AA202),                                                                                       | Not applicable                                                                  |                                                                                                                                                                                                    |
| Cation Conductivity analyzer            | (SWAS PANEL SCOPE) | 0.3 $\mu$ s/cm (at 25°C), increasing (HIGH) | Close MFC (QCL10AA202)                                                                                                             | Yes (Oxygen dosing stopped due to high cation conductivity in feed water cycle) | Increase ammonia pH set point to raise pH to 9.2-9.5 range                                                                                                                                         |
| Dissolved oxygen analyzer               | (SWAS PANEL SCOPE) | 30 ppb (LOW), decreasing                    | Gradually open MFC (QCL10AA202) to increase DO provided signal from PT (QCL10CP001) is "NOT LOW" (i.e < 45 Kg/cm <sup>2</sup> (g)) | Yes (Low DO level in feed water cycle)                                          | Initial set point may be chosen as 90 ppb. However, provision may be kept to choose exact set point for operation by operator's plant chemist during commissioning within the range of 30-150 ppb. |
| Dissolved oxygen analyzer               | (SWAS PANEL SCOPE) | 150 ppb, increasing (HIGH)                  | Close MFC (QCL10AA202) to decrease DO                                                                                              | Yes (Oxygen dosing stopped due to high DO level in feed water cycle)            |                                                                                                                                                                                                    |

**During Start up:-**

|                              |                    |                                                  |                                                                                                                                                          |                             |  |
|------------------------------|--------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--|
| Cation Conductivity analyzer | (SWAS PANEL SCOPE) | 0.15 $\mu$ s/cm (at 25°C), decreasing (ADEQUATE) | Open MFC (QCL10AA202) , provided signal from PT-3 is "NOT LOW" (i.e < 46 Kg/cm <sup>2</sup> (g)) & signal from DO analyzer is "NOT HIGH" (i.e > 150 ppb) | Yes (Oxygen dosing started) |  |
|------------------------------|--------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--|

**For Skid dosing at deaerator Outlet**

| Source of signal                        | Tag Number | Set Point (suggested) | Interlock | Alarm in DCS | Remarks |
|-----------------------------------------|------------|-----------------------|-----------|--------------|---------|
| <b><u>During Normal Operation:-</u></b> |            |                       |           |              |         |



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|                              |                    |                                             |                                                                                                                                                         |                                                                                 |                                                                                                                                                                                                    |
|------------------------------|--------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pressure transmitter         | PT (QCL21CP001/2)  | 22 Kg/cm <sup>2</sup> (g) (HIGH)            | Not applicable                                                                                                                                          | Yes (HIGH pressure at cylinder 1 outlet)                                        | Manual checking of pressure regulator reqd.                                                                                                                                                        |
| Pressure transmitter         | PT (QCL21CP001/2)  | 17 Kg/cm <sup>2</sup> (g) (LOW)             | Close SV-1 (QCL21AA201) & Open SV-2 (QCL22AA201)                                                                                                        | Yes (LOW pressure at cylinder 1 outlet)                                         | Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.                                                                                                                    |
| Pressure transmitter         | PT (QCL22CP001/2)  | 22 Kg/cm <sup>2</sup> (g) (HIGH)            | Not applicable                                                                                                                                          | Yes (HIGH pressure at cylinder 2 outlet)                                        | Manual checking of pressure regulator reqd.                                                                                                                                                        |
| Pressure transmitter         | PT (QCL22CP001/2)  | 17 Kg/cm <sup>2</sup> (g) (LOW)             | Close SV-2 (QCL22AA201) & Open SV-1 (QCL21AA201)                                                                                                        | Yes (LOW pressure at cylinder 2 outlet)                                         | Auto-changeover of cylinders. Manually replace cylinder 2 with filled cylinder.                                                                                                                    |
| Pressure transmitter         | PT (QCL20CP001/2)  | 18 Kg/cm <sup>2</sup> (g) (LOW)             | Close MFC (QCL20AA202)                                                                                                                                  | Yes (Oxygen dosing stopped due to low pressure)                                 |                                                                                                                                                                                                    |
| Pressure transmitter         | PT (QCL20CP001/2)  | 24 Kg/cm <sup>2</sup> (g) (HIGH)            | Not applicable                                                                                                                                          | Yes (HIGH dosing pressure)                                                      | Manual checking of pressure reducing regulating valve reqd.                                                                                                                                        |
| Pressure transmitter         | PT (QCL20CP001/2)  | 20 Kg/cm <sup>2</sup> (g) (Adequate)        | Open Permissive pressure of MFC (QCL20AA202).                                                                                                           | Not applicable                                                                  |                                                                                                                                                                                                    |
| Cation Conductivity analyzer | (SWAS PANEL SCOPE) | 0.3 µs/cm (at 25°C), increasing (HIGH)      | Close MFC (QCL20AA202)                                                                                                                                  | Yes (Oxygen dosing stopped due to high cation conductivity in feed water cycle) | Increase ammonia pH set point to raise pH to 9.2-9.5 range                                                                                                                                         |
| Dissolved oxygen analyzer    | (SWAS PANEL SCOPE) | 30 ppb (LOW), decreasing                    | Gradually open MFC (QCL20AA202) to increase DO provided signal from PT (QCL20CP001) is "NOT LOW" (i.e < 18 Kg/cm <sup>2</sup> (g))                      | Yes (Low DO level in feed water cycle)                                          | Initial set point may be chosen as 90 ppb. However, provision may be kept to choose exact set point for operation by operator's plant chemist during commissioning within the range of 30-150 ppb. |
| Dissolved oxygen analyzer    | (SWAS PANEL SCOPE) | 150 ppb, increasing (HIGH)                  | Close MFC (QCL20AA202) to decrease DO                                                                                                                   | Yes (Oxygen dosing stopped due to high DO level in feed water cycle)            |                                                                                                                                                                                                    |
| <b>During Start up:-</b>     |                    |                                             |                                                                                                                                                         |                                                                                 |                                                                                                                                                                                                    |
| Cation Conductivity analyzer | (SWAS PANEL SCOPE) | 0.15 µs/cm (at 25°C), decreasing (ADEQUATE) | Open MFC (QCL20AA202), provided signal from PT-3 is "NOT LOW" (i.e < 22 Kg/cm <sup>2</sup> (g)) & signal from DO analyzer is "NOT HIGH" (i.e > 150 ppb) | Yes (Oxygen dosing started)                                                     |                                                                                                                                                                                                    |